

# THE SPECIES OF *ADONIS* L. NATURALIZED IN AUSTRALIA

by

P. M. KLOOT\*

## SUMMARY

Hitherto, the species of *Adonis* naturalized in Australia have been identified as *A. annuus* and *A. aestivalis*. This study reveals that on the basis of achene morphology, these two species are not present in Australia. The naturalized species is actually *A. microcarpus* DC. A detailed description based on Australian material is provided, and the distribution of the specimens lodged in Australian herbaria is recorded.

## INTRODUCTION

On a world-wide basis, the annual species of *Adonis* (Fam. *Ranunculaceae*) are most conspicuous as garden plants. They have been cultivated for almost four hundred years in Europe and Great Britain and have been spread far from their native Mediterranean habitat to the Americas, Asia and Australia. In restricted localities, some species have begun to cause problems as weeds of crop or pasture. This has happened in parts of the cereal belt of South Australia.

A study of the weed revealed, *inter alia*, that the current Australian nomenclature was inconsistent with both the specimens and the descriptions published in the local literature. Hitherto, this plant was identified as *A. annuus* L. emend Huds. (syn. *A. autumnalis* L.). This originated from the early botanists, Maiden (1912) in New South Wales, Manson-Bailey (1909) in Queensland, and Black (1919) in South Australia, who, knowing it to be a garden escape, assumed it was the species commonly grown in Great Britain. Later workers appreciating that the morphology of Australian specimens differed markedly from European descriptions of that taxon suggested that it was *A. aestivalis* L., another British garden species (Eichler, 1965; Willis, 1972). The determination of the Australian material is reported in this paper.

## MATERIALS

Fresh material was examined in the field at every opportunity, and collections made where practicable in South Australia between 1968 and 1972. The collected material was lodged in the State Herbarium, Adelaide (AD).

---

\* S.A. Department of Agriculture and Fisheries, Adelaide.

Both local and overseas specimens of *Adonis* were kindly made available by the curators of the following herbaria: State Herbarium, Adelaide (AD). Herbarium, Waite Agricultural Research Institute, Adelaide (ADW). Queensland Herbarium, Brisbane (BRI). Herbarium, Canberra Botanic Gardens (CANB-BG). National Herbarium, Melbourne (MEL). Herbarium of the University of New England, Armidale (NE). National Herbarium, Sydney (NSW). Herbarium of the Northern Territory, Alice Springs (NT). Western Australian Herbarium, Perth (PERTH). Herbarium, Department of Agriculture, Adelaide. Personal herbarium of Dr. H. Eichler, Canberra, formerly of Adelaide.

The material was critically examined for variability in achene size and shape and, where relevant, petal colour.

As type specimens and other basic diagnostic material are unavailable in Australia, reference was made to the various accounts mentioned herein, but greatest reliance was placed on the revision by Dr. H. Riedl (1963).

The extra-Australian material available for examination, together with descriptions and keys in the European literature, gave an opportunity of gaining an appreciation of the taxa in their native countries and enabled the placement of the Australian specimens.

The determination of the Australian material thus achieved was confirmed by both Dr. H. Riedl (W) and Professor C. Steinberg (FI).

## OBSERVATIONS

A full description of the plant is given on p. 204. Only the features of the flowers and fruit required for the species determination will be considered in this section. A discussion of the variation in vegetative characters, and other floral features not included here is available elsewhere (Kloot, 1973).

**FLOWER COLOUR:** The material from all States except South Australia invariably had red petals. Most of the South Australian material was also red, but yellow-flowered plants are found in two localities: the Roseworthy-Freeling area about 40–70 km north of Adelaide, e.g. AD 97202249, and the South Hummocks area about 90–100 km north-north west of Adelaide, e.g. AD 96933755.

It was noticed that red-flowered specimens from well-favoured areas tend to be crimson, whereas in less favoured sites the flowers tend to be scarlet.

**THE ACHENE:** A diagrammatic sketch of an achene is shown in Fig. 1. All the terms used in describing the achene are shown there.

**SIZE:** Apart from the N.S.W. material where the achenes were generally 2.5 to 3.0 mm long (including the beak), the Australian examples ranged from about 3.0 to 3.5 mm long, although larger achenes to 4.5 mm long were seen.

SHAPE: No basal tooth on the achene was seen in Australian specimens. This is an essential characteristic of *A. aestivalis* and its patent absence in local material unequivocally rules out the possibility of this taxon being present in the current collections.

A transverse ridge is always found in mature Australian achenes. In larger achenes there is a tendency for the ridge to be undulate whereas in smaller (but mature) achenes the ridge is dentate. The dentate ridge is most highly developed in specimens from the Northern Flinders Ranges in South Australia (AD 96529270) and from Parkes in N.S.W. (NSW 63759), and to a lesser extent in a collection from Alice Springs N.T. (NT 9338) and Georgetown S.A. (AD 97202263).

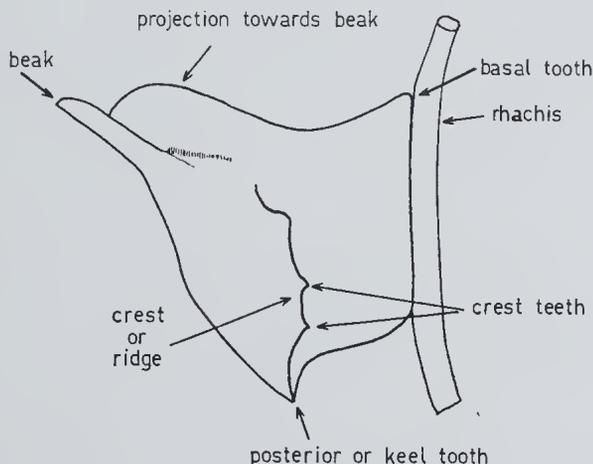


Fig. 1.—Generalised diagram of *Adonis* achene illustrating descriptive terms used in the text.

At the most posterior point on the ridge a tooth varying in size and prominence is always present. Where the crest is dentate, this posterior tooth is usually less obvious; conversely, if the crest is undulate this tooth is generally more prominent.

In the Australian material, the projection on the exterior surface close to the beak is always present in mature achenes. In *A. annuus*, this projection is never found. It is not so close to the beak that they touch as in *A. flammeus*, nor is it as far removed as in *A. aestivalis*. In the latter species it is about one-third to one-half of the distance from the beak back towards the base of the achene. In local material it is generally only one-fourth this distance.

THE DIRECTION OF THE ACHENE BEAK: This distinction between a beak pointing horizontally (i.e. perpendicularly to the rhachis) and a beak pointing vertically (i.e. parallel to the rhachis) is virtually the sole criterion for a number of authors to divide



Fig. 2.—Typical spike of *A. microcarpus* illustrating the effects of stem position on achene maturity and beak direction.

*A. cupanianus* Guss. from *A. microcarpus* DC. However, as shown in Fig. 2, the distinction between ascending and horizontal beaks is likely to be worthless. The lower, more mature achenes are often forced outwards, but as the smaller, upper achenes are not as crowded the beaks point upwards. If the lower achenes fall, then the plant appears to be bearing only achenes with ascending beaks.

Later authors, e.g. Riedl (*op cit.*), Tutin *et al.* (1964) and Davis (1965) ignore this distinction treating *A. cupanianus* as a synonym of *A. microcarpus*.

THE SUITABILITY OF MATERIAL FOR DETERMINATION: Critical taxonomic studies should be made on fully mature achenes. These fall readily from the rhachis, so unless they are collected carefully, enclosed and mounted separately on the herbarium sheet, they are usually missing. The achenes that do remain

are immature, and as these differ considerably from fully mature achenes, determination is impossible. Davis (*op cit.*) has previously drawn attention to unripe achenes leading to misidentification. The author's own observations (Kloot, 1973), indicate that for achenes to be suitable for taxonomic determination they must: (a) contain a viable (i.e. round, blackish-green) seed, (b) be the lowest occurring on the fruiting head, (c) be from healthy, well-watered plants growing under reasonably fertile conditions, and (d) be fully ripe, i.e. they will drop from the stem at a light touch.

### CONCLUSIONS

Overall, there were only minor differences between all the specimens examined. If the criterion of achene maturity is strictly adhered to, then the only substantial variation is in the colour of the corolla being red or yellow and the degree of dentation of the transverse ridge.

As the yellow-flowered forms were only a very minor proportion of the population in specific locations and with no other differences, this feature does not constitute a specific difference. There was a distinct gradation in the degree of dentation on the transverse crest between plants from arid environments and those from wetter localities, to which attention has previously been drawn by Riedl (*op cit.*). Therefore, the degree of dentation is seen as continuous variation rather than indicating two discrete populations.

The names previously used in Australia, *A. annuus* and *A. aestivalis* are not applicable. The projection towards the beak and the presence of a ridge around the achene exclude the former, and the lack of a basal tooth, as well as the position of the projection towards the beak exclude the latter. By close examination of the literature, it is clear that of the annual *Adonis* spp. the only taxa that are not excluded are those of *A. dentatus* Del. ssp. *microcarpus* (DC.) Riedl and *A. dentatus* ssp. *intermedius* (Webb et Berth.) Riedl.

The local material compared very closely to the descriptions given by Davis (*op. cit.*) or Steinberg (*op. cit.*) for *A. microcarpus* DC. in which they include *A. dentatus* ssp. *intermedius* Riedl. This arrangement is useful for the Australian material as the specimens with well-developed dentate transverse ridges referred to previously, would be more closely referable to *A. dentatus* ssp. *intermedius* Riedl.

The European specimens available to the writer that were identified as *A. microcarpus* DC. or *A. cupanianus* Guss. were identical with or very similar to Australian material.

It is thus considered, and subsequently it was confirmed by Dr. Riedl in Vienna and Dr. Steinberg in Florence that the Australian representative of *Adonis* is referable to *A. microcarpus* DC. As Riedl's two subspecies are included in this taxon, the Australian material is adequately encompassed.

## TAXONOMIC DESCRIPTION

**Adonis microcarpus** DC. *Syst.* 1 : 223 (1817)

*A. cupaniana* Guss. *Fl. Sic. Syn.* 2(1) : 37 (1843); *A. dentatus* Del. subsp. *intermedius* (Webb et Berth.) Riedl in *Ann. Nat. Mus. Wien* 66: 72 (1963); *A. dentatus* subsp. *microcarpus* (DC.) Riedl *op. cit.*: 73 (1963).

Annual erect to 55 cm high, often multi-branched; *stem* striate, sparsely villose towards base but glabrous above; *stem hairs* simple, colourless; *leaves* alternate, to 6 cm long and 4 cm broad obovate in outline upper leaves gradually diminishing, glabrous, bright green, deeply dissected, bi- or tripinnate with more or less linear segments, each segment to 4 mm long, 1 mm broad, terminal segment to 8 mm long, acuminate, lower leaves petiolate, upper leaves sessile; leaf-like cauline *bracts* subtending the base of each petiole (lower leaves) or leaf (upper leaves).

*Flowers* (8-) 15-25 (-30) mm diam., solitary, terminal, borne on a peduncle which lengthens as the flower matures to be  $\pm$  4 times length of mature carpellary spike; *calyx* appressed to the spreading corolla, but reflexing when mature; *sepals* 5 to 12 mm long, 6 mm broad, obovate, sparsely villose towards base and on lower margins (hairs similar to stem hairs), glabrous elsewhere, purple, petaloid, apex obtuse, slightly undulate; *corolla*, suberect initially, but spreading flat as flowers mature; *petals* (5-) 6-8 (-10), to 15 mm long, 8 mm broad, obovate, glabrous, bright scarlet (also crimson and occasionally yellow) with black basal spot, drying to yellow in herbarium specimens, apex obtuse, sinuate to crenate, remainder of petal margin entire; *stamens* numerous, hypogynous consisting of dark purple anthers 1 mm long borne on filaments to 4 mm long; *gynoecium* of 10-50 superior carpels each with single-celled ovary containing one anatropous, pendulous ovule.

*Achenes* 10-50, conferted, maturing acropetally along the spike which is 1.0-2.5 cm long, the uppermost achenes rarely maturing; *immature achenes* ovoid to globose, little ornamentation if any, beak lying parallel to rhachis, colour varying from blue-green to off-white, individual achenes clinging firmly to rhachis; *mature achenes* 2.5-4.0 mm long with a short beak to 1 mm long protruding from the posterior-dorsal surface  $\pm$  perpendicularly to the rhachis, globose, rugose, with transverse ridge, often toothed in specimens from arid situations, but the ridge tending to be obscure in plants obtained from favoured sites, keel tooth always present at bottom of transverse ridge, rugose surface, sandy-brown to off-white, occasionally dull shades of green; *seed* to 1.5 mm diam. round, plump, blackish-green.

Flowering from July to November.

*Seedlings.* Cotyledons linear, acute, to 4 cm long, 3 mm broad, pale yellow-green; first true leaf petiolate, similar to other stem leaves but considerably smaller. Seedlings emerge soon after opening rains in April to June depending upon the season.

### DISTRIBUTION

In southern and eastern Australia, on calcareous soils, adventive in other areas. The collection sites of herbarium specimens examined are mapped in Fig. 3. Details of the examined material are listed hereunder. (Only selected specimens have been listed for South Australia).

**SPECIMENS EXAMINED:** Western Australia.—Cadoux, R. D. Royce 8397, 27.viii. 1967 (PERTH); Manmanning, H. B. Smith & Co., ix. 1967 (PERTH); Toodyay, J. D. & P. J. Somers, viii. 1968 (PERTH).

Northern Territory.—4km N.W. Alice Springs P.O., Adventive in garden area, R. Swinbourne 464, 19.ix.1962 (NT 9338).

Queensland.—Darling Downs—Jimbour lands, J. T. Bell, 1909 (BRI 10032); Pirrinuan, Barnes Bros., (BRI 10035); Pirrinuan, on Jimbour Creek, mainly low lying areas, 27.viii.1958 (BRI



Fig. 3.—Collection sites of herbarium specimens of *A. microcarpus* DC. in Australia.

15719); Dalby, viii.1952 (BRI 10030 and BRI 146724); between Dalby and St. Ruth, black soil, *S. L. Everist*, 2.x.1954 (BRI 10034); Toowoomba, *H. Jarvis Bo. 2*, 10.x.1938 (BRI 10031); Goondiwindi, x.1905 (NSW 130030); Allora, close to old Talgai homestead, reddish-brown loam, *Huntely*, 10.viii.1962 (BRI 33483).

New South Wales.—North Western slopes—Moree, x.1909 (NSW 51324 and NSW 51325); Warialda, i.1910 (NSW 51328), x.1915 (NSW 51327 and NSW 51328); Inverell, viii.1912 (NSW 51324), x.1912 (NSW 51331 and NSW 51332), ix.1951 (NSW 51333), x.1905 (NSW 51335); Gurley (S.E. of Moree), x.1930 (NSW 51330); Terry Hie Hie (S.E. of Moree), no date (NSW 51326); *J. W. Simpson*, 12.xi.1968 (NE 25032); “Berrigal district” (a later note “may be Berrygill 33 miles N.E. Narrabri”), x.1903 (NSW 51339); Narrabri, ix.1955 (NSW 51336); Tamworth, ix.1955 (NSW 51337). Central Western slopes—Turill, ix.1962 (NSW 63758); Temora, x.1915 (NSW 51338); Parkes, 1963 (NSW 63759). Far Western Plains—Broken Hill, Hospital garden, *A. Rainbow*, ix.1927 (Ex coll. *Albert Morris*, ADW 16902).

Victoria.—Wimmera—Dimboola, *H. Faux*, early x.1960 (MEL 36765). Western District—“Lindsay” 40 km NE Mt. Gambier, *J. B. Cleland* 16.ix.1945 (AD 95828049).

South Australia.—Eyre Peninsula—Nundroo, 250 m W of road-house near house ruins, *S. J. Garrick*, 3.ix.1971 (Ex Kloot, AD 97308241); Mt. Hope, Hd. Kiana, Sn. 96, common on heavier flats between limestone rises, *C. R. Alcock*, ix.1968 (Ex Kloot, AD 97202240). Far North—Northern Flinders Ranges, ca. 10 km E of Angepena homestead on Italowie Gorge Road, *T. R. N. Lothian* 2487, 27.ix.1964 (AD 96529270). Mid North—1 km S. Redhill, small patch, *P. M. Kloot K7015*, 8.x.1970 (AD 97202256); Clare, 1917, (Ex *J. M. Black* colln. AD). Yorke Peninsula—2 km E. South Hummocks telephone exchange, red flowers, *B. Copley* 1493, yellow flowers—*B. Copley* 1492, 1.ix.1967 (AD 96933746 and AD 96933755 respectively); Hd. Tiparra Sn. 401, very widespread in area, *P. M. Kloot K7004*, 9.ix.1970 (AD 97202245); Stansbury, *H. W. Cornish*, 22.ix.1939 (ADW 3891). Lower North—Allendale North, Hd. Kapunda Sn. 1564, low fertility pasture, *P. M. Kloot K7003*, 10.ix.1970 (AD 97202244); Dutton, Hd. Dutton Sn. 102, *P. M. Kloot K7009*, 27.x.1970 (AD 97202251); Roseworthy, *A. Adams*, ix.1915 (Ex Herb. *A. Adams* incorp. in *J. M. Black* colln., AD); Roseworthy, Hd. Nuriootpa Sn. 719, red flowers, *P. M. Kloot K7007*, yellow flowers, *P.M. Kloot K7007A*, 2.xi.1970 (AD 97202248 and AD 97202249 respectively); Murray Mallee—Sutherlands, *Boehm*, 20.ix.1929 (Ex *J. M. Black* colln. AD); nr. Callington, Hd. Monarto Sn. 2016, *A. V. Lehmann*, 24.x.1966 (ADW 34662). Other—Beaumont, amongst weeds, *J. B. Cleland*, 5.x.1945 (AD 95828050, also dupl. in *J. M. Black* colln.); Coonalpyn, Hd. Coneybeer Sn. 24, *S. Whisson*, Spring 1971 (Ex Kloot colln. K7102, AD 97308202).

---

### ACKNOWLEDGEMENTS

The help and advice of Dr. Hj. Eichler formerly of the State Herbarium, Adelaide, now of Canberra, Prof. Dr. C. Steinberg of Florence and Dr. H. Riedl of Vienna was greatly appreciated during the course of this work. The assistance of Mr. D. E. Symon of the Waite Agricultural Research Institute, Adelaide was freely given through the project and during the preparation of the manuscript.

### REFERENCES

- Black, J. M. (1919)—Additions to the Flora of South Australia No. 15. *Trans. Roy. Soc. S.A.* **43**: 23–44.
- Davis, P. H. (1965)—Flora of Turkey **1**. (Edinburgh University Press).
- Eichler Hj. (1965)—Supplement to the Flora of South Australia. (Govt. Printer: Adelaide).
- Kloot, P. M. (1973)—Studies in the ecology of Pheasant's Eye (*Adonis microcarpus* DC.) M.Ag.Sc. Thesis, University of Adelaide.
- Maiden, J. H. (1912)—Botanical Notes. *Ag. Gaz. N.S.W.* **23**: 810.
- Manson-Bailey, F. (1909)—Contributions to the Flora of Queensland and British New Guinea. *Qld Agric. J.* **23**: 217.
- Riedl, H. (1963)—Revision der einjährigen arten von *Adonis* L. *Ann. Nat. Hoffmus. Wien* **66**: 51–90.
- Steinberg, C. (1970)—Revisione sistematica e distributiva della *Adonis* annuali in Italia. *Webbia* **25**: 299–351.
- Tutin, T. G. et al. (1964)—Flora Europea **1**. (Cambridge University Press).
- Willis, J. H. (1972)—A Handbook to Plants in Victoria **2**. Dicotyledons. (Melbourne University Press).